

Eat Smart for a **Healthy Heart**

An estimated 80 million American adults—one in three—have one or more types of heart disease, says the American Heart Association (AHA), based in Dallas, Texas. Diet can have a significant effect on reducing the risk of developing heart disease. Since even people on statins (cholesterol-lowering

and colleagues has found that sticking to the 2005 *Dietary Guidelines for Americans* reduced the progression of arterial plaque—the buildup of fatty deposits in artery walls—in women who already had the disease. The guidelines provide authoritative advice about how dietary habits can promote health and reduce risk for major chronic diseases.

Lichtenstein is director of the Cardiovascular Nutrition Laboratory at the Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts University in Boston, Massachusetts.

She and colleagues examined data on eating patterns of 224 postmenopausal women. Multiple angiographs—which measure the degree of coronary artery disease—were taken of each volunteer at the beginning and end of a 3-year study period. The researchers used a comprehensive measurement to score adherence to both individual and overall dietary components of the guidelines. They also used a mathematical method known as “regression analysis” to assess diet-disease associations. The women who showed a greater adherence to the overall guidelines had less progression of their atherosclerotic lesions over the 3-year period.

“We established that individual dietary components do not have the same weight as the total diet in terms of describing diet-disease relationships,” says Lichtenstein. “This is important from a public health perspective, because the work supports the development of effective dietary guidance for preventing health problems.”

The findings highlight the need for more sophisticated approaches to assessing the effect of dietary recommendations on various chronic diseases, wrote the authors.

The 2009 study was published in the *American Journal of Clinical Nutrition*.

Food Chemical Findings

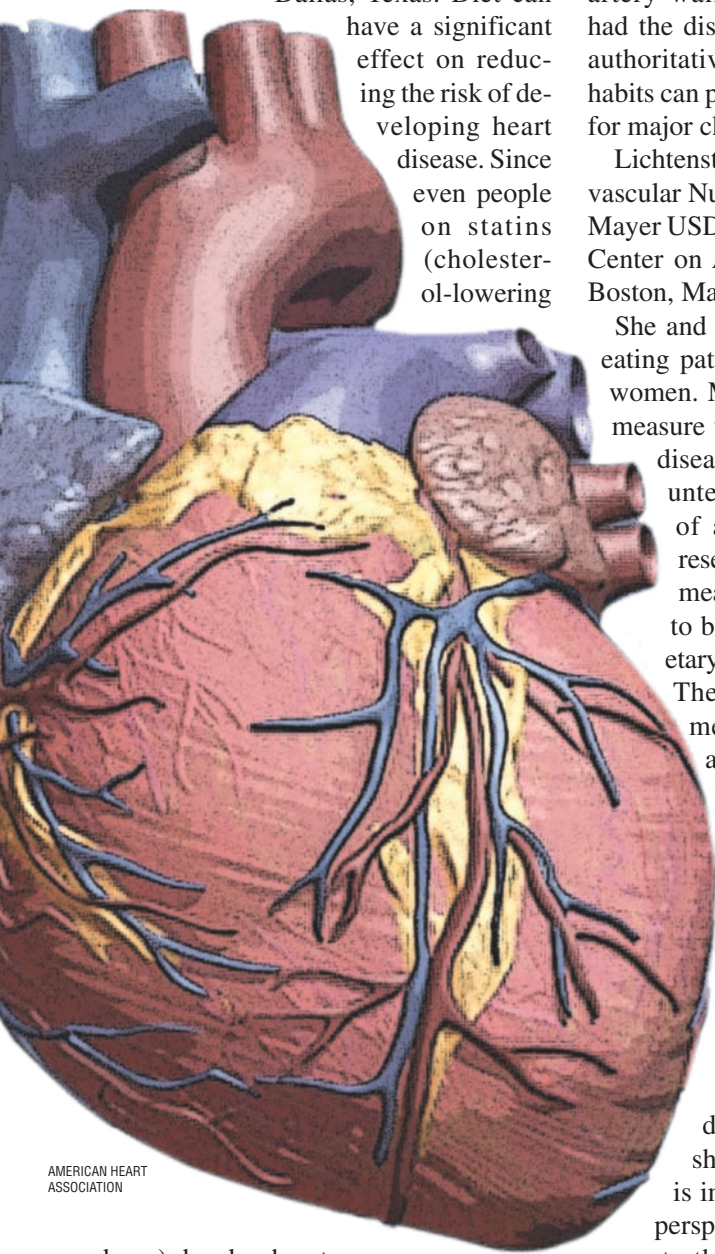
Some consumers clearly are striving to eat well as a way to prevent or delay heart problems that eventually could require taking prescription medications. In response, food companies are adding naturally occurring nutrients to foods in higher-than-natural concentrations as a way of helping consumers.

The term “phytosterols” refers to sterols and stanols, which are compounds found in small quantities in plants. When consumed by humans in large quantities, phytosterols reduce arterial plaque buildup. In plants, these compounds are similar in structure and function to cholesterol, and in humans, they work by blocking the absorption of cholesterol in the small intestine.

“Phytosterols are not naturally found in any one food serving in high enough levels to have an effect on cardiovascular disease,” says Lichtenstein. Numerous clinical trials have shown that consuming foods enriched with at least 0.8 grams and up to 3 grams of plant sterols or stanols daily lowers serum low-density lipoprotein (LDL “bad”) cholesterol. By comparison, a consumer would have to eat at least 100 or more carrots to get the equivalent of 0.8 grams of plant sterols, depending on size and composition estimates.

Significantly, plant sterol-supplemented food products—such as margarine spreads and orange juice—are now widely marketed to consumers for eating once a day with breakfast. “Studies are needed to examine the effects of plant sterol consumption *frequency* on circulating blood cholesterol as part of a diet low in saturated and trans fats,” says Lichtenstein. She and colleagues studied the effect (on blood cholesterol levels) of giving volunteers plant sterols once in the morning compared with giving sterols three times a day.

Lichtenstein analyzed lipid (blood fat) profiles of 19 study volunteers from blood samples taken after each of three 6-day study phases—a relatively short intervention period. For the control phase, the volunteers were given a precisely



AMERICAN HEART ASSOCIATION

drugs) develop heart attacks, dietary interventions should not be underestimated.

Dietary Components Are Key

Evidence suggests that dietary patterns have a lot to do with the development of heart disease. A study conducted by nutritional biochemist Alice Lichtenstein

Consuming plant sterols once a day—in the morning—was not as effective at lowering plasma LDL cholesterol as consuming them three times a day.



controlled weight-maintaining diet, with no plant sterols. For the second phase, the volunteers were given the same diet, but with a standardized amount, 1.8 grams, of plant sterols in margarine with breakfast. For the third phase, the volunteers were given the same diet, but also 1.8 grams of plant sterols divided equally and given during each of the three meals per day.

Volunteers consumed their regular, habitual diets for 2 weeks in between each study phase.

The study found that consuming a single morning dose of plant sterols was not as effective at lowering plasma LDL cholesterol concentrations as was consuming the plant sterols three times per day. Among the three-times-per-day group, measures of cholesterol absorption decreased by 6 percent compared to controls.

The authors concluded that, based on the study, plasma LDL cholesterol is lowered most when plant sterols are consumed in smaller amounts given more often, rather than in one large amount.

The 2009 study appears in the *European Journal of Clinical Nutrition*.

Good Food Components—and Not

Not all food components affect blood lipid chemistry positively. Before the 1990s, public health recommendations to use less animal fats and tropical oils spurred food producers to partially hydrogenate fats—a process that introduces trans fatty acids (or trans fats) into fats of vegetable origin. Multiple research studies conducted throughout the 1990s show that partial hydrogenation and resulting trans fatty acids raise serum cholesterol levels. And a 1999 study headed by Lichtenstein shows a linear relationship between increased dietary intake of partially hydrogenated fat and increased levels of LDL cholesterol.

A more recent study led by Lichtenstein shows that substituting corn oil for partially hydrogenated soybean oil during a 35-day diet lowers risk factors for heart disease in women who already had moderately high cholesterol. Thirty

women aged 50 or older participated in this fat-consumption study.

“For this study, we were not looking at any one specific amount of partially hydrogenated fat; instead, we wanted to know whether a shift in the type of fat used in food preparation would have a significant effect on plasma lipid levels,”

says Lichtenstein. “We were interested in documenting how much of a difference would occur if a relatively large number of producers made this switch. And what we found was that, yes, it does make a significant difference.”

The 2009 study was published in *Atherosclerosis*.

STEPHEN AUSMUS (D1812-8)



Research volunteers are provided with experimental diets for 5-6 weeks per phase. Here, nutrition technician Chervonte Hernandez (left) and nutritional biochemist Alice Lichtenstein (right) discuss a study diet with a participant.

STEPHEN AUSMUS (D1811-5)



Study coordinator Janey Ronxhi (left) and Metabolic Research Unit nurse Margaret Vilme obtain a blood sample from a volunteer for determination of lipoprotein profile.



STEPHEN AUSMUS (D1805-24)

Graduate student Shannon Washington prepares a plasma sample for determination of fatty acid profiles.

The Right Fats, in the Right Amounts

Not surprisingly, AHA is working to increase awareness among consumers about the health benefits of reducing intakes of trans fatty acids without increasing intakes of saturated fats. AHA commissioned a tracking survey between 2006 and 2007 to measure changes in consumer awareness, knowledge, and behaviors in regard to fats and oils and their perceived impact on heart disease. Both surveys included a representative sample of the American population—1,000 adults, ages 18 to 65.

The 2006 AHA consumer research survey revealed that while 84 percent had heard the term “trans fats,” close to half were unaware of the negative health effects they cause.

“We want people to get the right message about eating fats as part of a balanced dietary approach to reducing the risk of cardiovascular disease,” says Lichtenstein, who co-chaired AHA’s 2006 “Trans Fat Conference” and coauthored the conference report in *Circulation* in 2007. “The message is that a moderate-fat

diet relatively low in trans and saturated fats but richer in monounsaturated and polyunsaturated fats is what people should be consuming.”

The authors concluded that collaboration between the food industry and nutrition professionals is important to addressing future food development, processing, and technology issues.

In another published study, Lichtenstein and coauthors reported an improvement in consumer awareness of trans fats. Among the 2007 AHA survey respondents, 92 percent were aware of trans fats—up from 84 percent in 2006. But overall consumer awareness, especially regarding food sources of saturated and trans fats, remains relatively low, according to the study authors. They published the findings in the *Journal of the American Dietetic Association* in 2009.

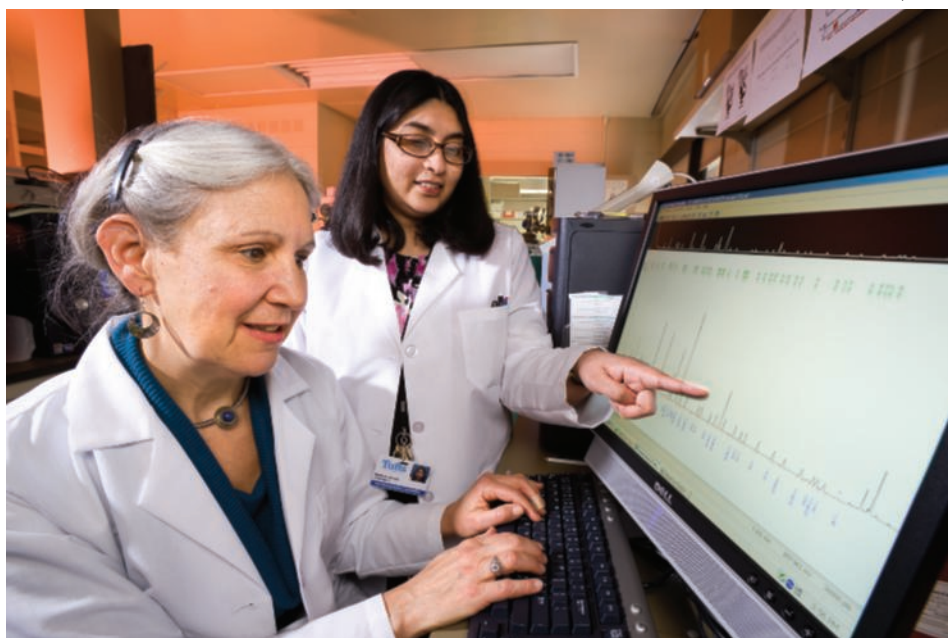
“The message that total fat alone is important, such as when low-fat diets were wildly popular, is oversimplified. If you simply consume a low-fat diet, then triglyceride levels go up, HDL (“good” cholesterol) levels go down, and a positive effect on body weight is not necessarily achieved,” says Lichtenstein.

This year, an estimated 1.2 million Americans will have a new or recurring heart attack, and nearly 200,000 more will have an undiagnosed or “silent” heart attack. Reducing risk factors such as elevated cholesterol and blood pressure through lifestyle changes can help avoid chronic health problems down the road. Such changes in daily routine can help save money on prescription drugs and overall healthcare costs while improving the quality of life for individuals.—By **Rosalie Marion Bliss, ARS.**

This research is part of Human Nutrition, an ARS national program (#107) described at www.nps.ars.usda.gov.

Alice H. Lichtenstein is with the Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts University, 711 Washington St., Boston, MA 02111; (617) 556-3127, alice.lichtenstein@tufts.edu.

STEPHEN AUSMUS (D1810-1)



Nutritional biochemists Alice Lichtenstein and Nirupa Matthan evaluate a chromatograph of fatty acids in a plasma sample.